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Botanicals: Potent against whiteflies

There are two reasons that compelled the proponents of this study to test 13 botanicals as means to control whitefly. Something has to be done to keep the insect pest from wrecking havoc on vegetables grown both under screenhouse condition, and on farms. Insecticides, the most commonly used means in fighting insect pests, were found to actually help in the propagation of the whitefly. (See story on page 11)



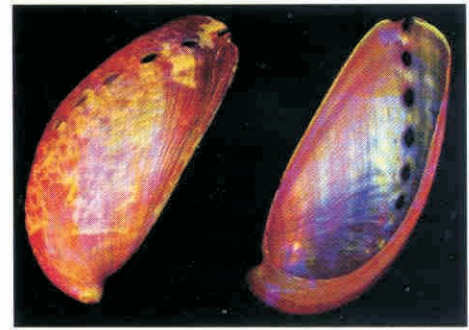
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Raising abalones

Scientists have been studying the best ways to culture the donkey-ear abalone, or *Haliotis asinina*. Armando Fermin and Shela Mae Buen of the Southeast Asian Fisheries Development Center (SEAFDEC) investigated the effects of shelter surface area of the mesh cages on the feeding, growth, and survival of this commercially important abalone. These mesh cages are suspended in flow-through tanks and the cages have sections of PVC that provide the surface area.



Donkey-ear abalone

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What is the abalone?

The donkey-ear abalone is abundant in the Indo-Pacific waters. Also called 'Sweet Cocktail Abalone', it is perfect for steamboat or soups. They say that it is much tastier than the cold-water species found in Australia, America, and South Africa and is the favorite species in Asia, especially the Chinese.

The donkey-ear abalone attaches itself to rocky surfaces with strong suction at its foot. Its ventilating stream enters just above the foot. The large foot that clings to rocks or spills out from its shallow shell is highly prized in Chinese cuisine. The abalone's shell is rounded to oval, with 2 to 3 whorls, and the last one auriforms (grown into a large 'ear') that's why it is called the 'ear-shell'. The back is convex, ranging from highly arched to very flattened. The inside of the shell consists of iridescent, silvery white to greenish mother-of-pearl. These shellfish uses several of the holes along the edge of the shell to excrete its waste.

An abalone trading firm in Thailand classifies abalones into two groups: the steak sized (found in the United States, Mexico, Japan, and Australia) which is grown within 36-48 months; and the cocktail sized (found in tropical waters of Philippines, Taiwan,

Indonesia, and Thailand) which is grown for only 12-16 months. They mature at 30-35 mm in shell length (SL) but they grow to a marketable size of 55-60 mm within a year.

This delicious gastropod can be a good source of: selenium (activates an antioxidant enzyme called glutathione peroxides, which may help protect the body from cancer); magnesium (important in the formation of bone, protein, fatty acid, and cell); vitamin B12 (needed in cell activities); and vitamin E (an antioxidant).

Raising the abalone

Experiments have been conducted to raise abalones in sea cages with the red macro-alga *Gracilariopsis bailinae* as feed. This red micro-alga is easy to grow in drainage canals and brackish-water ponds in the Visayas and sells at P6-8 per kilo.

Abalones are herbivores in general and they feed on micro-algae during the early stages then shift to seaweeds at juvenile stage. Stocking density, according to studies, has an inverse relationship with abalone growth. Animal movement, in relation to feeding, is dependent

on the amount of available space for foraging and/or shelter, especially in cages.

With this knowledge of abalones, Fermin and Buen investigated the effects of varying shelter surface inside rearing cages. They also determined the effectiveness of *G. bailinae* as feed for growing abalone for nine months. The researchers found that the tropical donkey-ear abalone can be stocked from 75-125 individuals per square meter for better grow-out rearing in suspended mesh cages with a cage volume of $CV = 0.0404 \text{ m}^3$ and a shelter surface area (SSA) of 0.44-0.66 square meter. The ratio of the SSA and CV should not be less than 10 in flow-through tanks. They also found that a steady diet of *G. bailinae* was effective for growing the donkey-ear abalone for nine months.

Sources:

- 1) Fermin, Armando C. and Shela Mae Buen. "Grow-out culture of tropical abalone, *Haliotis asinina* (Linnaeus) in suspended mesh cages with different shelter surface areas". *Aquaculture International*. 9: 499-508. 2002. Southeast Asian Fisheries Development Center Aquaculture Department (SEAFDEC-AQD), Tigbauan, Iloilo.
- 2) Thai abalone, Ltd. Retrieved from the world wide web at www.thailandabalone.com
- 3) Photo: www/gastropods.com

A lake's crisis threatens livelihoods

Laguna de Bay is a critical resource in agricultural food commodities and industrial raw materials in the 28 lakeshore towns that surround it. It is located in the midst of the country's developing urban and industrial hub with Metro Manila lying at the western portion. It embraces part of Laguna and Rizal provinces, and some parts of Batangas, Cavite, and Quezon.

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But what is considered the largest freshwater lake in Southeast Asia is dying. The team of Dr. Macrina Zafaralla assessed the ecological status of Laguna de Bay, and gave recommendations on how to deal with the lake's impaired ecology. An understanding of the lake's situation will help save the singlemost important livelihood resource in the region.

The lake

The origin of Laguna de Bay has not been really established. However, latest findings give evidence that the Lake could have been formerly part of the Manila Bay. Various layers of marine shells from the water basin

of the Lake are of the same species as those shells living in Manila Bay waters today. Also, identical species of marine shells were also found in the upper shores of the town of Bagumbayan (now Luneta Park), and in Marikina at the Pasig-Marikina River junction.

Today, Laguna de Bay has a total surface area of about 90,000 ha and an average depth of 2.8 m. There are 21 tributaries that drain into the lake. Thirty-five percent of freshwater drains from Pagsanjan River, while 15% comes from the Sta. Cruz River. The only outlet of the lake is the Napindan Channel, which converges with the Marikina River. The result is the Pasig River that winds along a 24 km course westward, cutting

through major parts of Metropolitan Manila, before eventually discharging into Manila Bay.

The enormity of the Lake can be summed up into a "Laguna de

Bay Region" that includes 6 provinces, 60 municipalities of which 28 towns are lakeshore, covering 177 barangays and 32 non-lakeshore towns. It occupies 1.3% of the country's total land area.

Slow death

The Lake is undergoing ecological stress, as attested by its plunging fish yields. This is because the food chain in the lake has been altered by pollution, high turbidity and sedimentation rate, and impaired biodiversity. One of the reasons that caused the deterioration of the lake environment was the building of a dam, the hydraulic control structure (HCS), across the Napindan channel. The dam regulates the water that flows in and out of the lake. After the structure was built, fish stocking densities in fishpens were reduced by 20-30%.

The structure of the zooplankton communities was also affected. The expanding fishpen industry and the operation of the HCS were two factors believed to have caused the decline in zooplankton biomass.

Since the lake has become shallow over the years, sediments at the bottom tend to get re-suspended by the changes in intensity and direction of the

Laguna de Bay



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weather, particularly the wind. This caused the lake to be perennially turbid. High turbidity caused the decline in algal biomass.

Compliance by the industrial firms surrounding the lake to legislations intended to protect the lake is low that is why pollution and heavy metals find their way to the lake in great quantities. The paper reported that only 6% of the wet industries around the lake has installed water pollution control devices. Water pollution not only decreased fish growth, but it also enabled fish parasites to abound in the lake, as well as reduced the fish' resistance to infection.

The lake that gives

As the country's biggest lake suffers a slow death, it would be reasonable to audit what its healthy existence means to the surrounding provinces that depend on it.

Laguna de Bay has been providing good fish harvest to surrounding towns since historic times. It provides food for the lake basin population and means of livelihood to approximately 17,000 fishermen residing in the various municipalities around the lake (LLDA Registration of Fishermen, 1992). The fishpen culture, introduced by the Laguna Lake Development Authority (LLDA) in the 1970s, proved to be highly effective, jumpstarting the lake fishery industry.

The lake also provides power through a pump storage hydroelectric power station operating in Kalayaan, Laguna, about 60 km southeast of Manila. The plant exploits the force produced in the area between the Laguna de Bay and existing

Caliraya Reservoir, (a man-made lake near Kalayaan) which produces 300 megawatts of electricity.

Agricultural lands in the southern and eastern parts of the lake region also benefit from the lake. The lake has sufficient water for year round irrigation of farmlands in lakeshore town as well as for some areas of adjacent Quezon and Cavite provinces. LLDA reported that the potential area that can be irrigated using lakewater is 102,456 ha.

It is a suitable transport route by lakeshore dwellers to places that are not easily accessible by road. It also provides the industries surrounding the lake a source of cooling water. More than 2 billion cubic meter of water is used for industrial cooling.

What can be done?

A Laguna de Bay Masterplan that contains means for sustainable lake development has been drawn by the LLDA. Dr. Zafaralla, et. al's paper also offered recommendations for a rehabilitation program that essentially asks for targets and indicators (of attainment of these targets) to be specified. These are two requirements that most resource management efforts in country often overlook, according to the paper.

The Laguna de Bay Masterplan recommended that the government should have a policy that regulates industrial growth near the lake. This would reduce the entry of more pollutants into the lake.

It said that the 20,000 ha allowed for aquaculture in the

lake should be re-evaluated in terms of ecological soundness. The factors considered in the evaluation should be the worsening siltation problem and the lake's inability to self-cleanse and provision of quality food for the fish.

These suggestions support the authors' recommendation of improving of the hydrological regime in the lake and its tributaries, controlling the entry of toxic and hazardous chemicals, controlling the growth of source of pollution, systematic implementing of closed and open season for fishing, and supporting community efforts to safeguard the lake's welfare.

The lake is not wanting of efforts and programs for rehabilitation, but the paper reiterated that these rehabilitation programs should be implemented regardless of the present and ensuing political climates.

The Laguna de Bay is both the pride and the life of the people that dwell in its shores and beyond. It is both urgent and virtuous to take pains in the rehabilitation of this important national resource.

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- 1) MT Zafaralla, RAV Santos, RP Orozco, GCP Elegado, "The ecological status of Lake Laguna de Bay, Philippines". Institute of Biological Sciences, University of the Philippines Los Baños, ICLARM, Penang Malaysia, and National Institute for Biotechnology and Applied Microbiology, College, Laguna. 2003
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Saving the *kapis*

Remember *Lola's kapis* windows in her house? How you whined when they got stuck as you open them in the morning. Did you ever wonder where those pearly white windowpanes came from? When I was a kid, I thought they were scales of some big fish, probably as large as a whale.

Actually, the *kapis* (*Placuna placenta*) is a bivalve (two shells hinged together) mollusc (like oysters and clams), or *lampirong* in the Panay island. These animals used to be plentiful in the coastal waters of the southern towns of Oton, Tigbauan and Guimbal, in Iloilo along the Gulf of Panay. According to the Southeast Asian Fisheries Development Center-Aquaculture Department (SEAFDEC-AQD), *kapis* meat contains 23.2 grams of protein per 100 grams, which is higher than those of mussels and oysters.

Kapis in danger

Aside from its meat, *kapis* is prized for its shells that are made into windowpanes, lampshades, chandeliers, coasters, and other ornamental household items. The *kapis* items were exported to the US, Germany, and the UK. In 1999, the shells and by-products earned about US\$18.9 million in export revenue.

However, the harvesting of and production of *kapis* handicrafts declined in recent years due to 'open access' fishery and destructive fishing practices. These resulted in the overexploitation and depletion of the natural *kapis* population. An article in the *Philippine Daily Inquirer* quoted Jocelyn Madrones-Ladja, a researcher from the Southeast

Asian Fisheries Development Center (SEAFDEC) in Tigbauan, Iloilo, saying that, "the demise of *kapis* in the coastal waters of southern Iloilo, one of the 27 *kapis* beds in the country, was due to the rise of prawn hatcheries and indiscriminate harvesting." This was evident in the late 1980s when prawn hatcheries flushed water with antibiotics back to the sea and the contamination might have killed the *kapis*, which is a filter feeder. The *kapis* is a prolific breeder but it was over-harvested by people hired by agents of shell craft companies. It was not given a chance to produce the next generation, making them endangered.

SEAFDEC started to develop seed production technologies of the *kapis* for mariculture and stock enhancement. For a successful breeding of the commercially important *kapis*, enough knowledge about their ecological requirements is needed. According to the study of Madrones-Ladja, "salinity tolerance and optimum salinity for growth are important environmental criteria in the selection of growing sites for the bivalves." Salinity of the water is important in the biological activities of the bivalves like the



Kapis (Placuna placenta)

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kapis and examples of these are reproductive cycles, development of embryos and larvae, and tolerance to high temperature fluctuations.

Salt of the sea

According to the website of the University of Guelph in Canada, there are three major factors that influence salinity (salt concentration) in Pacific Ocean waters: precipitation, evaporation, and winds. "Precipitation brings freshwater into the ocean, diluting its salt concentration. The rate of evaporation from the ocean's surface waters is also important because it removes water molecules, leaving the salt behind." In regions where the evaporation is high due to winds and high temperatures, (like in the Philippines) the concentration of salt in the water increases. As a result, areas of water exposed to the strong trade-winds generally have higher salinity values.

"High salinity values are over 35 parts per thousand or ppt (the unit of measure of sea water salinity), while values below this are considered low. Around the equator, where amount of rainfall is large, surface salinity rarely exceeds 34 parts per thousand. The lowest salinity occurs in the

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Saving the kapis...

extreme northern regions of the Pacific, near the Bering Sea, where concentrations are often less than 32 parts per thousand.

Salinity and the kapis

Results of the study showed that *kapis* survive and settle in salinities of 16 - 34 ppt. Settlement happened first (in 14 days) in salinities of 22-43 ppt. It settled later (19 days) in salinities reaching 16 ppt when shell length (SL) is more or equal to 200 micrometers. The best salinity levels for a developing embryo and larvae ranged from 22 to 34 ppt and 16 to 34 ppt, respectively. "The tolerance of *P. placenta* to lower and higher salinities progressively increased as larvae develop from embryo to the plantigrade (walking stage)," Madrones-Ladja concluded.

The ability of the larvae to tolerate low salinity, like 10 ppt for 12 days could mean that the *kapis* could adapt to life in estuaries, which is characterized by high daily salinity fluctuations, the researcher added. In fact, bivalves are often encountered in estuaries, coves, and bays with muddy floor. In many cases, these areas are more or less completely landlocked with mangrove swamps along the shore and frequently with brackish water because of rivers and streams flowing into that area.

Madrones-Ladja said that this information can be used as a guide for forecasting spat (a young oyster or other bivalve), expecting high quantity during periods of salinity, which is often observed after the second spawning season from October to December." Suitable broodstock management and

larval rearing techniques, meanwhile, can improve seed production of the *kapis*.

However, no amount of success can overcome extinction if the coastal communities do not help in the propagation of the *kapis*. Keeping them from over-harvesting the bivalves is another big step towards making the Ilonggo coastal shores teeming again with the bivalve I once mistook as a scale of a huge fish.

Sources:

- 1) Madrones-Ladja, Jocelyn A. "Salinity effect on the embryonic development, larval growth, and survival at metamorphosis of *Placuna placenta* Linnaeus (1758)". *Aquaculture* No. 214. 2002.
- 2) Labiste, Ma. Diosa. 'Kapis' makes comeback in Iloilo. *Inquirer News Service, Iloilo City*. Retrieved from the world wide web at www.inq7.net
- 3) Salinity. University of Guelph, Canada. Retrieved from the world wide web at www.aquatic.uoguelph.ca

Feedbacks...

serious threat to vegetables and ornamentals. But again, plant extracts from tobacco, hot pepper, *luyang dilaw*, are potent in the control of this pest (page 11). In the near future we may not have enough silk, the undisputed queen of textiles, because of the mulberry red rust that attacks mulberry trees whose leaves are the only food of the silkworm (page 12). Recently, too, the silkworms have become sick with jaundice caused by a virus. Scientists are using the enzyme-linked immunosorbent assay (ELISA) to determine whether the silkworms have the virus before they exhibit physical symptoms (page 14). Even the garlic that is purportedly used to ward off the aswang is not spared from viruses, pests, and diseases. But there is

now a technology that produces virus-free planting materials (page 15). Abaca, the source of the Manila hemp, which put the country in the world map, is also sick with the bunchy top virus and the only way to save it is through genetic transformation (page 21). What about our soils for corn growing? There are ways to ameliorate all soil type deficiencies (page 19). Our animal population, too, is being threatened. The native *kambing* is an important genetic resource so it is being characterized to help in its conservation (page 22). The good news is, we can now tap science and technology for a brighter, cleaner, and healthier future. All those degradable wastes can be made into organic fertilizer very fast

with the use of a fungus, *Trichoderma* (page 9). Even the Philippines' yearly 60,000 tons of plastic waste can now be decomposed (page 16).

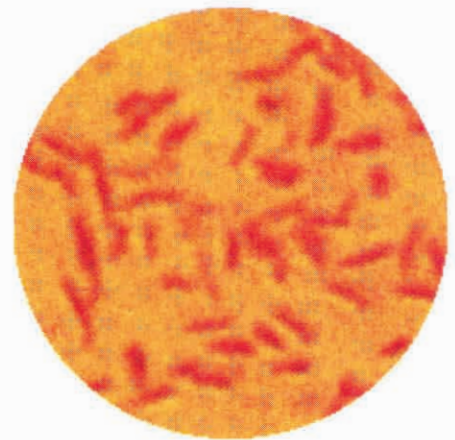
A tropical country like the Philippines produces plenty of fruits and some of these are seasonal. We produce a lot of mangoes during summer and they cannot all be consumed within a certain period. Drying is one way of preserving them. Dried mangoes are good but they can be better through osmosis (page 17). Osmotic dehydration can remove 50% of the water from fresh, ripe fruits.

Problems. Problems. But they can be solved as fast as they loom because of science and technology. Today and tomorrow. - VAD

Luminous bacteria: Bane to shrimp farming

In the dark, the pond glowed with blue-green phosphorescence. The farmer smiled as he looked at the beautiful and magical picture it made. However, three days later when almost all of the shrimps in the pond were dead, the farmer was cursing the thing that made the pond glow.

The "thing" is a kind of luminous bacteria or *Vibrio harveyi* and it is one of the most serious diseases affecting shrimps today.



Vibrio harveyi

Characteristics of *Vibrio*

Luminous bacteria are single-celled, often parasitic microorganisms without distinct nuclei or organized cell structures. They are similar to enteric bacteria or those bacteria that thrive in the intestines. Luminous bacteria have motion organs called flagella but you can only see them under a light microscope if you used a special staining process. In the case of *Vibrio*, its flagellum is enclosed in a sheath that is continuous with the outer membrane of its cell wall.

Luminous bacteria reproduce and clump together to form "colonies" measuring 2-8 mm in diameter. Their ability to glow or become luminous depends on the availability of oxygen in their culture media. Scientists reported that luminous bacteria glow as a result of something like aerobic respiration. While ATP or adenosine triphosphate (an energy compound) results from the normal aerobic respiration, luciferase is produced in a similar reaction in luminous bacteria. Luciferase is a compound which can generate

light. Luminous bacteria usually glow when they are grown in culture media since they tend to clump more.

Researchers have also found that luminous bacteria produce a specific chemical compound or an autoinducer that induces the glowing reaction.

Greenwater system: Initial control for *Vibrio*

It has been reported since 2000 that the greenwater culture system is an effective method in managing luminous bacteria. The greenwater culture system is an innovative technique of shrimp and fish culture wherein microalgae such as *Chlorella* is grown abundantly. In a recent study, the scientists determined the effect of tilapia water and *Chlorella* on the population of luminous bacteria. They found that both components- either the tilapia water or *Chlorella* are effective in controlling the luminous bacteria in six and three days, respectively. Thus, the scientists recommend the greenwater culture system as

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another component in an integrated system to manage luminous bacteria in the ponds. They say that the greenwater culture system is ideal because it is low-cost, easy to manage, and environment-friendly.

Other control methods

Other ways of controlling or eradicating luminous bacteria in ponds is by using antibiotics and probiotic bacteria. In the case of antibiotics, it is very important to apply antibiotics at the right amount and at the right time for it to be effective. Applying antibiotics in large quantities is not a wise move and in some cases ineffective and often results to more virulent pathogens. There are also concerns that heavy use might transfer antibiotic resistance to human beings.

Probiotic technology is done by adding beneficial microorganisms to the pond to eliminate the harmful microorganisms. In this method, the beneficial bacteria should be

Trichoderma: An all-around fungi for organic farming

You can lessen the use of chemical fertilizers and pesticides in your farms. Use fungi.

Many people balk at the idea of using fungi or any microorganisms in their farms. When people think about microorganisms (or microbes to some), they automatically associate it with diseases or 'germs'. On the contrary, microorganisms are helpful in a lot of ways. As the Food and Agriculture Organization (FAO) said, "Farmers need to understand that most micro-organisms are not pathogens. Each of the groups of microorganisms (fungi, bacteria, viruses, and nematodes) contains some members that cause plant diseases, but each group also contains many members that are beneficial."

Trichoderma is one of those microscopic fungi that can help farmers. "Some fungi are natural enemies of plant diseases. These beneficial fungi are called antagonists, because they infect, attack or compete against (antagonize) the fungi that cause plant diseases." *Trichoderma* is a well-known antagonist, according to FAO scientists. On the other hand, there are some species of *Trichoderma* that help in the production of organic fertilizers, like *T. harzianum*, that speeds up the rate of decomposition.

A study by Dr. Virginia C. Cuevas of the Institute of Biological Sciences (IBS) and Dr. Alfredo M. Sinohin and Eduardo A. Arro of the Department of Plant Pathology, both in UP Los Baños, explored the effectiveness of using two *Trichoderma* species (*T. parceramosum* and *T. pseudokoningii*) in controlling *Sclerotium rolsii*.

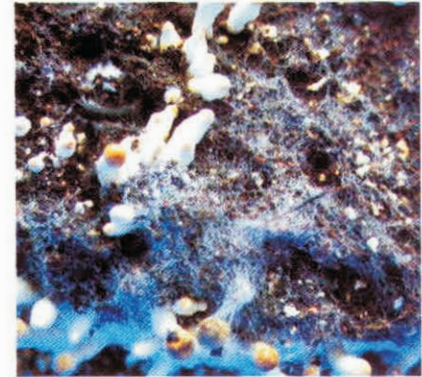
S. rolsii is a soil-borne fungus that causes diseases (pathogenic) in 39 crop species in the Philippines. *S. rolsii* penetrates the roots of its host plant. This

pathogen is tough; it can survive harsh conditions by being dormant and then it germinates when the conditions are good.

This is one of the main reasons why chemical pesticides/fungicides can't effectively control this pathogen. According to an FAO paper, "using fungicides to control soil-borne diseases usually is not effective; it depends on how deep below soil surface the pathogen can live and it is unclear how deep the fungicide can go. Some pathogens live inside plant debris in the soil, where they are protected from fungicides." Since farmers think that they haven't sprayed enough they would bombard the soil with fungicides further. This, in return, would backfire since it's the groundwater that would get affected.

Fungi as biocontrol for plant diseases

Cuevas and her team observed that vegetable farmers in Benguet use



Trichoderma harzianum

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propahydrochloride to control pre-emergence damping-off in pak-choi (*Brassica chinensis*) or Chinese mustard and post-emergence damping-off in rice grown after pak-choi. When the disease proves to be too much to control, some farmers change seedbed areas after several plantings aside from applying chemical fungicide. "Most farmers sow a large volume of seeds to ensure the survival of enough seedlings for their use." Cuevas and her team observed.

In the researchers' study, *Trichoderma* was as effective as the chemical fungicide in controlling pre-emergence damping-off in pak-choi. Similarly, *Trichoderma* was the only control method that was effective in controlling post-emergence damping-off and seedling blight in rice.

The percentage of surviving pak-choi and rice seedlings after application of *Trichoderma* was 80% and 90%, respectively, which is four times higher than those the plots treated with chemical fungicide. Seedlings are vulnerable to attack by *S. rolsii*, according to

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Trichoderma...

Cuevas, because they are still very succulent; they are composed of primary tissues and, therefore, can easily be penetrated by the hyphae (fine, branching tubes which make up the body of a fungus) of the pathogen.

How did the sudden increase of surviving seedlings happen?

The researchers found that the timing in the seeding of the fungi is very important. In the experiment, the ideal application time for the *Trichoderma* pellets (combination of rice bran pellets with mixed culture of *T. paracerasomum* and *T. pseudokoningii*) is two weeks before seed sowing and another application a week before seed sowing. "It is the most appropriate time for the antagonist (*Trichoderma*) to act on the pathogens since they are most vulnerable at this stage. When the crop (*pak-choi*) was harvested, the pathogen was left without any host tissue to invade," the researchers said.

At this stage, *S. rolfsii* is weak and it could easily be out-competed in the use of the limited organic materials (to feed on) left in the field. In its weak state, the *Trichoderma* parasitized *S. rolfsii* when the former was introduced in the field. "The two-week period when no host was available for the pathogen gave the antagonist lead time to establish sufficient population in the field for effective control of *S. rolfsii* before the seeds became available as hosts," Cuevas said.

The future with Trichoderma

Trichoderma has a very big

potential as bio-control for diseases like damping-off and seed blight. "Biological control of the disease using *Trichoderma* is a long term process but it is ecologically sound," Cuevas concluded. "It is a normal component of the fungal flora of the soil with high organic matter content, therefore, its natural enemies are already present in the environment and it has no adverse effects on other crops." However, a more thorough understanding of the dynamics in the control process between the antagonist and the pathogen is needed for bio-control to be successful.

We can say that *Trichoderma* has gone a long way, from just being a common soil-borne fungi to organic fertilizer activator and now bio-control for destructive plant diseases.

Sources:

- 1) Cuevas, Virginia C., Alfredo M. Sinohin, and Eduardo A. Arro, Jr., Efficacy of *Trichoderma* spp. as biological control agent of *Sclerotium rolfsii* Sacc. The Philippine Agricultural Scientist. Vol. 84, No 1. 35-42. Jan-Mar. 2001. Institute of Biological Sciences, College of Arts and Sciences, University of the Philippine Los Baños, College, Laguna
- 2) Disease ecology. FAO Inter-Country Programme for the Development and Application of Integrated Pest Management in Vegetable Growing in South and South-East Asia. 2000. Cabbage Integrated Pest Management: An Ecological Guide. Vientiane, Lao PDR

Luminous...

more competitive so that they could successfully eliminate the harmful bacteria. In a related

study, researchers reported that they were successful in controlling *Vibrio* when they added some *Bacillus* species to a pond ravaged by *Vibrio* and they reported an 80-100% survival of the shrimps.

IPM: Boon to shrimp farming

According to the United Nations Food and Agriculture Organization (FAO), half of the world's seafood demand will be met by aquaculture since wild capture fisheries are overexploited and are in decline. Likewise, the shrimp industry is expected to provide a large slice of the demand pie with the healthy growing demand, and its current worth of US\$10 billion. Hence, it is important and timely to design an integrated pest management scheme to protect the industry from the onslaught of *Vibrio* and other diseases. Scientists recommend a management scheme that includes the greenwater system, antibiotics, and beneficial bacteria as well as cultural practices as the most effective roadmap to manage *Vibrio* in the ponds.

Source:

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- 2) David Moriarty of the University of Queensland. "Colonization of disease control in shrimp aquaculture with probiotic bacteria in microbial biosystems: New frontier". Proceedings of the 8th International Symposium on Microbial Ecology, Bell CR, Brylinsky M, Johnson-Green P (ed.) Atlantic Canada Society for Microbial Ecology, Halifax, Canada, 1999.

Botanicals: Potent against whiteflies

There are two reasons that compelled the proponents of this study to test 13 botanicals as means to control whitefly. Something has to be done to keep the insect pest from wrecking havoc on vegetables grown both under screenhouse condition and on farms. Insecticides, the most commonly used means in fighting insect pests, were found to actually help in the propagation of the whitefly.

With limited options to turn to, a team of researchers led by Berly Tatoy and Fe Abragan at the Northern Mindanao Integrated Agricultural Research Center (NOMIARC) determined what plants are effective in fighting off the whitefly.

The damaging whiteflies

After whiteflies began showing resistance to synthetic insecticides, they were considered a serious threat to vegetable and ornamental production. They feed on plants as well as produce honeydew, which attract other insects and sooty mold. Whiteflies can also transmit plant viruses.

These powdery, soft-bodied insects that grow to about 1/2 to 1.8 inches long, are found in the underside of the leaves. Both the nymphs and adults infest the plants by sucking the plant sap. They are also quick to reproduce as the females can lay 25-150 eggs a day.

Several species of whiteflies attack plants and they typically have a wide host range because they can resist insecticides. The most common whiteflies on crops

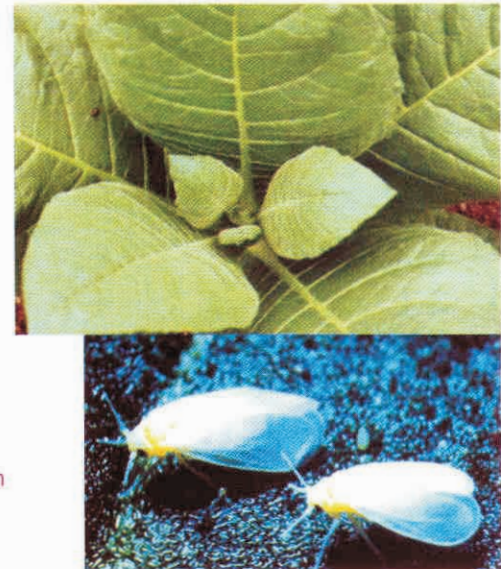
are the greenhouse whitefly (*Trialeurodes vaporariorum*) and the sweetpotato whitefly (*Bemisia tabaci*).

The various whitefly species and biotypes look very much alike, but they have subtle physiological differences. These differences can cause them to respond differently to control strategies.

The magnitude of the damage that the insect pest can inflict was recognized after it caused millions of dollars of losses in Western and Central America during a whitefly outbreak in 1992. The urgent need to find ways to control it also became urgent and critical when it was found that the outbreak was triggered by the incessant use of chemicals and other synthetic means to control pests in farms and greenhouses alike.

Botanical control

Studies have been made in the past to explore the effectiveness of using plants in fighting insect pests. Using biological control in controlling



Top: *Nicotiana tabacum*, one of the botanicals effective against whiteflies
Bottom: Adult whiteflies

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whitefly is gaining appeal and support because it prioritizes food safety while maintaining a harmonious relationship with the environment. It also can provide ways to minimize dependence on chemical control which encourages the proliferation of the insect pest.

Plants that control whiteflies

Researchers at NOMIARC found that among the 13 plant extracts tested, tobacco (*Nicotiana tabacum*), hot pepper (*Capsicum frutescens*), luyang dilaw (*Curcuma longa*), and tubli (*Derris elliptica*) are the most potent plant against the pest. The slow-acting control agents were the neem leaves and seeds, madre de cacao (*Gliricidia sepium*), panyawan (*Tinospora crispa*) and sunflower (*Tithonia diversifolia*).

Samples from the plants

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Botanicals...

were homogenized in a blender and were fermented for 24 hours. They were then passed through a cotton cloth and the filtrate was used for the experiments. Those that were considered as fast-acting poison killed the insect pest upon contact, while those classified as slow-acting killed the whiteflies slowly by interfering with their metabolism.

These botanical insecticides can be processed in different ways. They can be applied as powder from crude plant materials, as spray from plant extracts, and as pure chemical following an isolation of the active ingredient in the plant.

The main disadvantage of the botanical insecticides is storage, because the extract tends to degrade rapidly due to changes in temperature and sunlight.

Cost and return analysis showed that among the botanical insecticides, crude extracts from the neem leaves gave the highest ROI (return on investment), followed by panyawan, tobacco, sunflower, and hot pepper, in this order.

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1) BF Tatoy, FN Abragan, FC Macabugto, JB Salvani, CT Apiag, LA Ramos. "Evaluation of indigenous botanical insecticides for the control of whitefly under screenhouse Condition", Northern Mindanao Integrated Agricultural Research Center(NOMIARC), Malaybalay, Bukidnon 2002

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All about silkworms

1) Mulberry red rust: Silk's arch enemy

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Silk, the undisputed "queen of textiles" and one of the most sought-after fibers in the world, is constrained by one of its most destructive enemies- mulberry red rust, a fungal disease that attacks mulberry leaves which is the exclusive feed of silkworms.

To address this problem, a group of scientists from the Sericulture Research and Development Institute of the Don Mariano Marcos Memorial State University (DMMMSU), Sapilang, Bacnotan, La Union studied the extent to which mulberry red rust affects the yield and quality of mulberry leaves and the effect of the disease on the development of silkworm and silk yield and quality. The scientists also investigated ways to control the disease such as host resistance, cultural practices, and the use of chemicals.

Silkworm and mulberry leaves

Silk is made from the cocoons of silkworms (*Bombyx mori*)- a yellowish caterpillar or the larva of an Asian moth. A cocoon is the silky covering that a silkworm weaves around itself before it becomes an adult. It usually takes two days for silkworms to completely develop into cocoons.

To make silk, the cocoons are first dried for an hour at 100 degree Centigrade so they will not turn into moths. Then the

cocoons are unwound carefully to make long threads. The threads are then spun and woven to make silk. One cocoon can produce about 1.5 km of yarn and eight to nine cocoons can produce one strand of silk yarn. About 2,500 cocoons are needed to make one meter of silk cloth.

To rear silkworms, the area should have a temperature that is between 21 to 30 degrees Centigrade, about 600 feet above sea level and at least six kilometers away from the coastal area. The most important thing to consider is to have enough mulberry trees since silkworms only eat fresh mulberry leaves. In fact, mulberry leaves have been their sole diet for more than 5,000 years.

Studies have shown that silkworms are quite smart in their exclusive preference for mulberry leaves. Scientists have found that mulberry leaves contain all the important nutrients silkworms need for growth and development. Fresh mulberry leaf contains 70-80% water, 20-30% dry matter. In the dry matter, crude protein is about 25%, crude fiber 25 % and ash 10 %. The leaf-silk inversion rate, or the feed efficiency of

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mulberry leaf for cocoon shell production, is the main index to evaluate leaf quality.

In China, 15 to 18 kg fresh leaves are needed to produce 1 kg fresh cocoon at the farmer level. A hectare of full-grown mulberry can feed about 200,000 silkworms in one rearing cycle.

Mulberry red rust (MRR)

Mulberry red rust (MRR) is caused by a fungus called *Aecidium mori* which has been tagged as the most destructive enemy of mulberry causing high yield loss. Infected plants have leaves with bright yellowish orange undersides. The disease can strip mulberry trees of their leaves and the trees may cease to grow, shrivel and die.

MRR is aggravated by the practice of planting mulberry in monoculture or as a single crop in the field. The disease usually infects mulberry during the cool months until summer and the pathogen may hibernate during unfavorable conditions in old or rotting plant parts.

MRR's effect on silkworms and silk yield

Scientists found that MRR affects the nutritional quality and yield of mulberry leaves. Chemical test results showed that healthy mulberry leaves contain higher moisture, proteins, carotenoids, and beta-carotene compared to infected leaves. In fact, severely infected leaves lose as much as 33% protein. These results explain the adverse effects of the disease on the growth and development of silkworms consequently affecting cocoon and silk yield and quality. The scientists also reported that younger larvae (3rd to 5th instar)

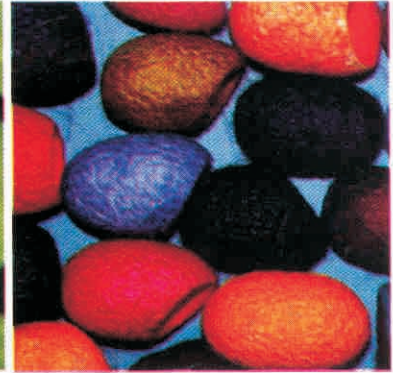
were more vulnerable to the disease as shown by higher mortality, delayed molting, and less feeding.

Also, infected silkworms produced lighter cocoons and filaments that frequently break during reeling. An economic analysis showed that MRR can reduce harvestable leaf yield from 10.05 tons to 9.305 tons per hectare or a 7.35% loss.

Managing MRR

To manage the disease effectively, the scientists recommend an integrated pest management scheme that includes the use of resistant cultivars, cultural practices such as pruning and branch density management, and chemical control or applying fungicides.

Among the 19 mulberry cultivars commonly used, only one (Alfonso) was found resistant, five (S₁₃, SRDC₂, C₆, Malba, and S₃₆) were moderately resistant, while the rest of the mulberry cultivars were susceptible to the disease. Sanitary pruning or cutting all the leaves of an infected mulberry plant significantly reduced the severity of the disease. As for chemical control, the scientists recommend spraying a fungicide (Thiobicarbamate) as early as seven days after pruning to control the disease. Using this timing, the scientists found no phytotoxic effect on mulberry plants and no residual effect on



Left: Mulberry leaves, Right: Dyed silk cocoons

silkworms during rearing.

Into the future

Recent surveys reveal a heavy demand for silk and other natural fibers especially in many European countries. In 2002, cocoon production was estimated at 2.8 metric tons showing a glaring volume deficit of 6,761.8 metric tons or 99.6%. This is the volume needed to meet the demand for raw material of the different sectors of the silk industry. Today, the government has speeded up efforts to boost the silk industry to meet its target of producing 162 metric tons of spun silk in 2006. This is quite an ambitious goal but with the right infrastructure and technologies to support enterprising farmers who want to venture into silkworm rearing and mulberry planting, most certainly not an impossible goal.

Source:

1) Angelino Gonzales, Oscar Opina, Lilia Ancheta, and Modesto Nillo of the Sericulture Research and Development Institute of Don Mariano Marcos Memorial State University. Sapilang, Bacnotan, La Union. Yield Loss Assessment of Silk Production and Development of Management Strategies Against Mulberry (*Morus alba* Linn) Red Rust Caused by *Aecidium mori* Barclay
Silkworm picture: www.geocities.com/thesciencefiles/silk/worm.html

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2) Catching silkworm's invisible enemy with ELISA

Silkworms (*Bombyx mori*), the humble makers of glorious, glamorous silk are one of earth's amazing wonders. For thousands of years, these worms have woven silk and catered to the vanities of men and women. But, recently silkworms have become sick from nuclear polyhedrosis, also known as grasserie or jaundice caused by a virus called *Bombyx mori nucleopolyhedrosis virus* or BmNPV.

While there are already conventional methods to control the disease, silk producers have no way of knowing whether the silkworms are already infected before it is already too late, thus resulting to a significant 40-70 % loss in cocoon harvest.

Rising to the rescue, scientists from the Sericulture Research and Development Institute of the Don Mariano Marcos Memorial State University (DMMMSU), La Union have developed a new protocol to detect whether the silkworms are harboring the BmNPV virus even before they exhibit physical symptoms.

BmNPV: The invisible enemy

Like other viruses, the BmNPV cannot be seen with the naked eye since it measures 30x45 nanometer- one nanometer is one billionth of a meter. BmNPV infects various tissues of the silkworms and multiplies in the nucleus forming inclusion bodies called polyhedra, which occlude virus particles. The virus is rod-shaped and contains double-stranded DNA or deoxyribonucleic acid- a nucleic acid molecule in the form

of a twisted double strand (double helix) that is the major component of chromosomes and carries genetic information.

Silkworms infected with BmNPV become bloated and yellow with swollen segments, hence the name jaundice. Its milky hemolymph becomes filled with small crystals which are actually polyhedral inclusion bodies. The hemolymph is a fluid in certain invertebrates that functions like the blood in vertebrates

BmNPV is highly infectious and causes high mortality in silkworms. In the experiments, the scientists found that age and rearing season significantly affected the survival rates of the silkworms. Survival rates were much higher during the November-December rearing seasons at 56.87% and 54.59% compared to the April-May rearing periods at 23.33% and 17%. As to age, they reported that silkworms become less susceptible to the virus as they mature, hence a 5th instar larvae is more likely to survive compared to a 3rd instar larvae.

Some chemical insecticides and pathogens also



Silkworm (Bombyx mori)

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increase the susceptibility of the silkworms to BmNPV. For instance, larvae that have ingested some bacteria or are treated with Sumithion and DDT become more susceptible to the virus.

ELISA: Catching viruses before it is too late

To detect if the silkworms were infected with the disease, the scientists used the indirect enzyme-linked immunosorbent assay or ELISA- a widely used technique for determining the presence or amount of protein in a biological sample, using an enzyme that bonds to an antibody or antigen and causes color change.

The scientists reported that the ELISA technique is a reliable and simple method for screening silkworms of the BmNPV virus as early as one day after inoculation even before the silkworms exhibited physical symptoms. It is also suitable for screening large numbers of samples for virus infection and is environment-friendly since it uses safe reagents.

Other control methods

To manage the BmNPV virus effectively, scientists have recommended practicing a concoction of control methods.

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Growing virus-free garlic

Garlic is one of the most economically important crops in the country with Northern and Central Luzon as the seat of production. About 5,700 hectares of land produces an average of 16,000 metric tons of garlic annually. This yield however, is low compared to other countries in the Southeast Asian region like Thailand.



Garlic or *Allium cepa*

This is attributed to the conventional means of propagation that uses single cloves. This method exposes the crop to viral infections and pests and diseases that cause yield loss to about 70%. A study conducted by Lilian Pateña, Lolita Dolores, Alice Bariring, Ramon Barba,

Erhard Barg, and Sylvia Green at the Institute of Plant Breeding at the University of the Philippines Los Baños, funded by the Bureau of Agricultural Research (BAR), sought to correct that oversight.

The marvels of garlic

Garlic does wonders both

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to the hungry stomach and to an ailing body. Its strong aroma makes it an important condiment for seasoning and flavoring. It is a vital flavoring for food that ranges

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Catching...

One important method is to disinfect the area, especially the instruments used in rearing the silkworms by spraying them with formalin or slaked lime water. It is wise to do this before, during, and after the rearing season to prevent the spread of the disease.

Another method is to rear silkworm varieties that are resistant to the virus. According to the scientists, resistance of the silkworm to NPV is controlled by polygenes that are mainly concerned with defense mechanisms of the midgut of the silkworm. Breeding resistant silkworm strains can be done through a prolonged selection of silkworms that are exposed to the virus. There are two practical methods for selection of resistant strain: batch selection and individual selection. In batch selection, sample larvae from each batch are tested for susceptibility to a virus and the most resistant batch is selected for further breeding.

In individual selection, the larvae of mixed batches are fed with a virus and the offspring of the surviving individuals are further exposed to the virus. The exposure to the virus is continued in the subsequent generations. While this method is faster compared to batch selection, there is the risk of losing the resistant strain during subsequent breeding due to the strong selection pressure applied.

Meeting the challenge

Today, there is a huge demand for silk and other natural fibers in the international market. However, silk-producing countries have not met the demand. In 2002, the supply deficit was estimated at 6,761.8 metric tons or 99.6%. This is the volume needed to meet the demand for raw material of the different sectors of the silk industry. Today, the government is doubling its efforts to ensure that the silk industry meet its target of producing 162 metric tons of

spun silk in 2006.

Hand-in hand with the right infrastructure provided by the government, it is equally important to have a cost-effective program to manage diseases of silkworms. Using the ELISA protocol, it is possible to diagnose silkworms with the virus before it is too late thereby, protecting a lucrative investment and ensuring the livelihood of silkworm farmers and entrepreneurs.

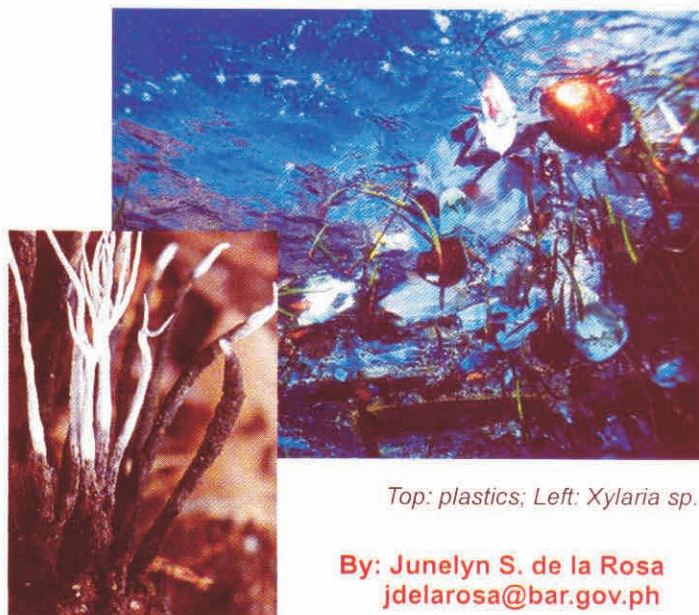
Source:

1) Minerva Tabafunda, Leodegario Padua, and Narceo Bajet of the Sericulture Research and Development Institute of Don Mariano Marcos Memorial State University. Sapilang, Bacnotan, La Union. "Pathogenicity of nucleopolyhedrovirus of silkworm (*Bombyx mori*) and its detection by ELISA". 2002

2) Hitoshi Watanabe of Nodai Research Institute, Tokyo University of Agriculture, Tokyo, Japan. "Genetic resistance of the silkworm, *Bombyx mori* to viral diseases" Special Section: Recent Advances in Silkworm Biology, Current Science, Vol. 83, No.4. August 2002

Fungi: A solution to Manila's plastic woes

Today, we are living in the middle of a ticking time bomb- Manila's garbage problem. Metro Manila produces about 8,000 tons of solid waste each day and is expected to reach 13,300 tons in 2014. With the lack of a proper waste management system, the explosion of this metaphorical time bomb is a likely scenario in the near future. But, there is good news yet. Scientists at the Institute of Biological Sciences in the University of the Philippines Los Baños have found a new solution to Manila's plastic garbage- a fungal species that can decompose or cause plastic to rot.



Top: plastics; Left: *Xylaria* sp.

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Our love affair with plastics

We have a love affair with plastics. From Styrofoam cups in our favorite Starbucks café, Styrofoam containers at our favorite fast food chains, to the ever-dependable plastic bag at the grocery store- plastics are virtually everywhere. In fact, we probably use plastics hundreds of times a day without knowing it. We are all aware of the boon that plastic has brought to our lives. Unfortunately, coupled with its benefits are its disadvantages to our environment where most of them still end up as waste.

What is plastic?

Plastic is an extremely versatile synthetic material made from the polymerization of organic compounds. Polymerization is a chemical process wherein a compound or a substance is made by adding smaller molecules. They are made from finite,

nonrenewable petroleum and natural gas.

While plastic products are cheap, making them is not. Plastics contain additives such as colorants, stabilizers, and plasticizers that may include toxic substances such as cadmium and lead. It is because of these substances that plastics may harm human health. For instance, plastic chemicals, such as ethylene dichloride and vinyl chloride used to produce vinyl are considered to be carcinogenic or cancer-causing. They may also trigger other health problems such as liver, kidney and neurological damage.

Getting rid of plastics

It has been said that next to diamonds, plastics are forever. This has made disposal of used plastics a cause for concern. Burning plastics is a no-no since plastic fumes can cause a wide range of ailments including skin

diseases, asthma, and some forms of cancer. Burning plastics releases noxious smoke and may release cancer-causing gases into the air which people have to breathe. Burying plastics with other wastes can contaminate soil and groundwater. Even recycling, widely endorsed to reduce solid wastes, does not effectively reduce the volume of used plastics.

In the Philippines, approximately 120,000 tons of plastics are generated each year, 50 percent of which end up in open dumping sites that are distributed in areas near Manila.

Biodegradation: A new way of getting rid of plastic

Scientists from the Institute of Biological Sciences in UPLB have found a new way of decomposing plastics. The new method is called biodegradation, the process of degrading waste material through the use of

Drying mangoes through osmosis

Traditionally dried mangoes are good. But they can get better through osmotic dehydration. This is what the study conducted by Ponciano S. Madamba, and Ronaldo I. Santos at the Institute of Agricultural Engineering of the College of Engineering and Agro-Industrial Technology at the University of the Philippines Los Baños (UPLB) found. The researchers explored the effect of time, temperature, sugar concentration, and thickness on osmotic dehydration of ripe carabao mangoes.



Dried mangoes

Osmosis is everywhere

Osmosis is defined as “movement of molecules through a semi-permeable membrane from a place of higher concentration to a place of lower concentration until the concentration on both sides is equal”. A semi-permeable membrane is a membrane that allows certain molecules to pass through it by diffusion.

The osmosis process takes place in every living thing. Osmosis aids in the distribution of nutrients and the release of metabolic waste products in and out of the body. A semi-permeable membrane, called the cell membrane, houses cells of plants and animals. This membrane regulates the flow of liquids and dissolved solids and gases in and out of the cell. In plants, osmosis is responsible for the absorption of soil water by root hairs, and for movement of the nutrients upward to the other parts of the plant.

Now, osmosis' role in post harvest handling is being explored by way of osmotic dehydration.

Drying to preserve

Fruits contain more than

75% water. This property allows them to spoil easily. One way to preserve fruits for the long term is through drying. An age-old means of preserving food that is cheap and effective, the most important component of traditional drying process is the sun. Yet when it comes to preserving food, the single most important concern is to maintain the wholeness and quality of a product.

Osmotic dehydration

Osmotic dehydration (OD) is an important process used in the food industry. It involves the immersion of a product into a concentrated solution (i.e. sugar), generating a partially dehydrated and impregnated product. Three simultaneous phenomena occur during this process: a) water flow from the product to the solution, b) a solute transfer from the solution to the product and, c) a minor transfer of product's own solutes (sugars, organic acids, minerals and vitamins) to the concentrated solution, the study says.

But for a fruit like mango that has a huge market both as

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fresh fruit, and as processed commodity, osmotic dehydration is a plausible choice of preservation. Osmotic dehydration can remove 50% of the water from fresh ripe fruits, e.g. banana, mango, papaya, apple, and other tropical fruits, and it also requires low temperature and energy.

What makes osmotic dehydration effective?

Samples of ripe carabao mango were selected for their uniformity and mass. The mangoes were then washed, manually peeled, and sliced into specified thickness. About 100 grams of sliced mango was used in each treatment. The osmotic solution contained sucrose or commercial sugar as the osmotic agent.

In each treatment, 100 g sliced mango was placed in a jar with 500 g of sugar solution, and the jars were placed in a water bath. After the treatments, the mango slices were removed from the solution and placed in a coarse filter paper to remove sugar residues from the surface of the

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Drying...

fruit.

The study used the response surface methodology (RSM) approach to estimate the main effect of the process variables on the mass transfer variables during osmotic dehydration. The scientists identified thickness, temperature, sugar concentration, and osmotic time as the independent variables while water reduction, sugar gain, final moisture content, and over-all acceptability the dependent variables.

Analysis of variance (ANOVA) was used to assess the effects of the independent on the dependent variables. The ANOVA showed that weight reduction was significantly affected by time, thickness, temperature, and sugar concentration. Sugar gain and final moisture content were significantly influenced by the thickness, while the independent variables have no effect on over-all acceptability.

The scientists pointed out that the responses from the mango on the best drying condition were: weight reduction at 30%, sugar gain of greater than 8%, final moisture content that is less than 70%, and over-all acceptability at least 60%. A minimum 30% weight reduction and final moisture content that is less than 70% will make osmotic dehydration a more sufficient pre-processing step. The best conditions generated were treatment time of 6 hours, temperature at 35C, sugar concentration of 65%, and 5mm slices of mangoes.

Sources: 1) Ponciano S. Madamba and Rolando I. Lopez. "Optimization of the osmotic dehydration of mango (*Mangifera indica* L.) slices", College

of Engineering and Agro-Industrial Technology, University of the Philippines Los Baños, Laguna 2002
2) G. A. P. Torezan, P. de Campos C. Favareto, D. Palleti, and H. Castle Menezes. "Osmotic dehydration of mango: Effects of temperature and process time". Department of Food Technology UNICAMP, Campinas, Brazil. Retrieved from the world wide web at www.feg.unicamp.br.

Growing...

from sautéed delicacies to pasta sauces. It has an important component in the preparation of drugs and pesticides. It has therapeutic value for blood circulation by inhibiting the formation of blood platelet lumps, and thus a positive effect in maintaining a sound immune and cardiovascular systems. The garlic's healing ability is attributed to the sulfur compounds that it contains.

Problems in production

Garlic is difficult to cross-breed because it reproduces asexually. It is grown in specific times of the year, from October to February, where the nights are cooler and the day drier compared to other months of the year. In the Philippines, garlic is grown in the Ilocos region and Southern Tagalog. Even with low yield, however, the country exports garlic to Singapore. In 1996, our garlic exports amounted to 267 tons valued at P5.3 million.

Pests and diseases are the main reasons why garlic production suffers huge losses. These include *Fusarium* bulb rot, *Cercospora* leaf spot, purple blotch, and garlic mosaic virus. This virus causes the leaf to twist and a mosaic-like design is

formed on the leaves.

Virus-free

The study conducted by the team of Dr. Pateña developed a technology that produces virus-free garlic planting materials. The technology is a combination of pre-treatment and tissue-culture strategies to clean up the planting material as means to eliminate the virus. Virus-indexing to certify that the materials are virus-free, and field planting to increase the number of materials for planting were performed.

Garlic bulbs were collected, the cloves separated, and washed in detergent and water, and then finally rinsed. The cloves were then pre-treated by putting some in a refrigerator (5 degrees Celsius), and some were left under room temperature for 1-4 weeks. The garlic cloves were then placed in bath water at 50 degrees Celsius for two hours, a process called thermotherapy. After thermotherapy, the cloves were sterilized for 15-20 minutes in a solution with 20% commercial bleach. They were rinsed using distilled water, and explanted by removing about 15-20 mm x 1.5 mm of the shoot tips in a basal plate. After a month, meristems were excised and allowed to form multiple shoots. After one and a half months, single shoots derived from the resulting multiple shoots were indexed, and those that were found virus-free were sub-cultured into a new medium for further shoot multiplication.

The development of a virus-free garlic technology started with a project by the Asian Vegetable Network (AVNET) Program from 1989 to 1997. However, not all plants were cleaned of the viruses. The AVNET program also performed virus-

Specific solutions to soil problems

Low corn yield cannot always be attributed to lack of good variety, typhoons, or pests and diseases. Above all else, low yield is due to soil fertility.

A study by the team of Dr. Henry Samonte investigated the fertility status of selected farms in major soil types of corn growing areas; determined the sufficiency levels of nutritional constraints; and gave corrective measures for higher corn yields in the specific farms.



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Soil fertility and corn yield

Adequate soil fertility is important to satisfy the needs of corn in all stages of its growth to achieve the highest yield. Along with these nutrient requirements, is the suitable acidity level of the soil (pH). If these nutrient conditions are achieved, there is no need to interfere in adjusting the fertility of soil.

But more often than not, the soil fertility requirements are not always met. Continuous leaching, build-up of acidic constituents, and the cycle of crop removal has impoverished the soil. A soil with low nutrient supplying capacity cannot give high yields. Farmers are unable to correct, or restore the soil to its optimum level. This causes low yield, and production losses even while using new high yielding varieties.

To be able to correct these nutrient deficiencies would mean knowing the kind and degree of nutrient constraints in the soil which may vary from one location to another even for soils with the same type.

Recommending a uniform rate of fertilizer across thousands of

hectares, moreover, does not correct these deficiencies. A corrective measure can only be done after the nature of soil has been determined using soil test values of the specific nutritional constraints.

Soil test values

To test the specific soil nutritional constraints of the different location chosen by the study, six experiments were conducted by the researchers.

The first one was, to determine the major nutrient element constraints in acidic soil and their solutions. The experiments were conducted at Manolo Fortich and Libona in Bukidnon, and at Reina Mercedes and Naguilan in Isabela, where the soil types in the two provinces were Adtuyon clay, Cauayan sandy loam, and Ilagan loam.

The second experiment determined the micronutrient constraints and how these were corrected. This was conducted at the same towns and provinces as the first experiment.

The third experiment determined the effects of

applying phosphorus (P), potassium (K), zinc (Zn) and molybdenum (Mo) in soils derived from limestone. It was conducted at Gitagum, Kalabaylabay, and El Salvador in Misamis Oriental. The soil type was Bolinao clay with the parent material being a limestone.

The fourth experiment determined losses in yield caused by different nutritional constraints. This involved the missing element technique where one nutrient after another was omitted from a complete treatment. It was conducted on Ilagan loam at Surcoc, Naguilan, Isabela.

The fifth experiment determined the spatial variability of components of soil and the nutritional constraints in major soil types. Soil samples were collected. Fifteen samples from 0-20 cm layer were collected from 110 farmers' fields in eleven provinces covering 29 soil types.

The last experiment established the pattern of nutrient requirement of soils planted with hybrid corn as basis for fertilizer recommendations.

Solutions per soil type and location

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Specific...

On Adtuyon clay at Manolo Fortich in Bukidnon that contains 0.18% total N and 4.2% organic matter, significant yield was obtained with 180 kg N fertilization. The study suggested that for a 97% yield or 7.86 tons/ha of harvest, 140 kg of N is necessary. The Adtuyon clay, which also contains 1.80 mg of P, corn responded positively to 180 kg P. The study suggested that for a 97% yield, approximately 150 kg of P is necessary. The same is true with K after the researchers observed that a 120 kg of K increased the yield significantly.

Liming the soil to increase its acidity from 4.70 to 5.45 pH did not increase the yield significantly.

As for micronutrients like zinc and copper(Cu), yield was significantly increased with 6 kg zinc and 2 kg Cu. The study concluded, therefore, that soil would respond to Zn and Cu if the soil test values for the two micronutrients were 2.8 and 10.6 mg, respectively.

For Bolinao clay, which was derived from limestone, it was expected to respond strongly to P, K, Zn, and Mo. But only the application of 120 kg of K effected a significant increase in yield.

For the Adtuyon sandy clay loam at Libona, Bukidnon, each level of N applied produced significant increase in yield. The highest was with the application of 180 kg of N. The same significant response was obtained with P application. This was because the soil test values obtained for P was low. Optimum yield was obtained at 110 kg of P application. Grain yield further increased with the

application of 3 tons of lime and 20 kg of magnesium with the 180-180-180 fertilization treatments. The Cauayan sandy loam at Labinab, Reina Mercedes in Isabela also exhibited favorable responses to nitrogen, phosphorus, and potassium additions. Highest yields were obtained at 170 kg of N, 151 kg of P, and 120 kg of K. Zinc and copper additions also increased yield. The study recommended applying 3 kg of Zn and 1.3 kg of Cu for optimum yield.

Significant variations were observed in different farms with the same soil-type for acidity, P, K, Ca, and Mg. These values were taken from samples taken at 0-20 cm to 20-40 cm deep. The study then concluded that a variable rate of fertilization method is more practical and suitable for the different size.

Nutrient accumulation and the pattern of dry matter in soil were observed. The testing areas were previously grown with hybrid corn, has 54% total nitrogen, phosphorus, and potassium components. It was also observed that after applying 160-80-80 + lime + chicken manure, the uptake of nitrogen rose to 90% from the 40% uptake it exhibited with the first treatment that involved no fertilization.

Source:

H.P. Samonte, A.M. Ocampo, S.O.P. B. Samonte, E.G. delos Santos, C.C. Lapoot. "Site-specific soil fertility constraints and their solutions for high yields in major soil types to corn". University of the Philippines Los Baños (UPLB), College, Laguna

Growing...

indexing that established the viruses that plagued the *Allium* family, such as the garlic mosaic virus, onion yellow dwarf virus, shallot latent virus, and garlic common latent virus.

This study, therefore, came up with an improved technique. Results showed that by using the meristem culture technique, the virus infected materials in the garlic, particularly the onion yellow dwarf virus, was successfully removed. The technique was proven to be 75% successful. Still, an improvement of this technology was done through cold pre-treatment and thermotherapy. Putting the garlic cloves inside the refrigerator for 3-4 weeks, with or without thermotherapy eliminated the virus. This improved technique is now routinely used for production of certified virus-free planting materials of the Ilocos White, Mindoro, and Tan Bolter cultivars.

The study concludes that the, "distinct advantage of this technology is that clean materials can be produced, stored for planting, and if re-infected, can be cleaned and rejuvenated".

Sources:

L. Pateña, L. Dolores, A. Bariring, R. Barba, E. Barg, and S. Green. "Technology for production of certified virus-free garlic (*Allium Sativum* L.) planting materials". Institute of Plant Breeding-UPLB, BBA Germany, and Asian Vegetable Research and Development Center(AVRDC). Funded by the DA-Bureau of Agricultural Research, and ADB-AVNET-PCARRD Program. 2003

Restoring abaca's health

Abaca fiber or Manila hemp is one of the major dollar earners in the Philippines contributing at least 10% of the total export value of Philippine products. In fact, from 1996-2000, abaca fiber contributed a whopping sum of 82.3 million US dollars. Recently, it has been touted as the natural fiber of the millennium.

But, the bad news is- our precious abaca may not even make it halfway to this millennium. Production rates have gone down with the attack of diseases especially by the abaca 'bunchy top virus' and researchers have predicted that if it is not restored to good health, healthy abaca might become extinct in 5 to 10 years.

Dr. Marilyn Belarmino, a breeding expert at the Department of Horticulture of Leyte State University (LSU) says a faster, reliable way to save the abaca is through genetic transformation. To do this, she developed a procedure to induce plant regeneration through a process called somatic embryogenesis.

What is somatic embryogenesis?

Plant somatic embryogenesis is a regeneration process wherein new plantlets are derived from a single somatic cell or a group of somatic cells. A somatic cell, also called a vegetative cell is any cell of the plant except the reproductive cells or gametes. Somatic cells are produced from preexisting cells and all the plantlets produced have the same genetic makeup. Today, somatic embryogenesis coupled with genetic engineering has

become an efficient means of producing large numbers of plantlets that have the same genetic makeup.

Abaca and its uses

Abaca, which is the Spanish term for Manila hemp, has been known since the 1820s during the famous Galleon Trade of the Spanish. Abaca is indigenous to the Philippines and is cultivated in almost all parts of the country.

Abaca or *Musa textilis* belongs to the banana family and can be distinguished from its famous cousin by its more slender stalk, narrower and pointed leaves, and a more pronounced dark line on the right of the upper surface of the blade. Also, abaca has smaller, non-edible fruits that contain many seeds.

Abaca fiber is classified based on how it has been extracted; it is either hand-stripped or spindle-stripped. Today, there are a variety of uses for abaca fiber. It is processed into cordage, pulp and paper products, microglass airfilters, and fibercraft such as handbags and hammocks, and other handwoven fabrics. It has also enormous potential as an ingredient for making fiberboards



Abaca (Musa textilis)

By: Junelyn S. de la Rosa
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and fuels.

The new procedure

The new procedure developed by Dr. Belarmino used three kinds of culture media corresponding to each stage: the initiation medium, the embryogenesis medium, and the regeneration medium. All media contained agar-solidified formulation with varying levels of growth hormones. Initiation is the first step of the procedure and involves the formation of meristematic globules on the basal portion of the shoot tips, embryogenesis consists of formation of somatic embryos, and the last step is the regeneration of plantlets. To enhance survival of the somatic embryos, they were placed in a pre-culture medium containing 1.0 mg/L of ABA for at

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Restoring...

least two weeks.

The shoot tips used in the study were taken from abaca suckers and measured 4 cm x 3 cm. The researcher also reported that among the abaca varieties used, the procedure was most successful with the *Putian* and *Inosa* varieties. Also, using this procedure, 15 to 16 plantlets can be produced by 1 gram of shoot tip.

Finally, preliminary DNA analysis of the new plantlets showed that they have the same DNA characteristics as the source or the mother plants. Also, the new plantlets have shown early and high suckering ability and resistance to the dreaded mosaic virus.

Implications

Using the new procedure, it would be easy to produce healthy abaca plantlets by the hundreds with exactly the same genetic material as the mother plant or the source. With that, this new procedure can benefit the whole abaca industry- from farmers who desperately need healthy abaca seedlings to entrepreneurs and exporters who need quality abaca fiber to biodiversity experts who want to save the genetic material of this valuable indigenous plant.

Thus, this new procedure has enormous potential not only to a wide slice of stockholders in the abaca industry, but can very well spur abaca to become the natural fiber of this millennium and even the next.

Source:

1) Belarmino, Marilyn. "Somatic embryogenesis and plant regeneration system in Abaca (*Musa textiles* Nee). Department of Horticulture. College of Agriculture, Leyte State University. February 2003

2) Abaca Situationer Report. Retrieved from www.bar.gov.ph

Getting to know the kambing

By: Likha C. Cuevas
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What makes the *kambing*, *kalding*, or *kanding* different from other goat breeds in the world?

That is the question that Dr. Orville Bondoc, Beatriz Garcia, Elizabeth Beltran, Maribel Rapusas, and Bryan Gomez of the College of Agriculture in UP Los Baños tried to answer. These researchers studied the characteristics of the Philippine native goats (*Capra hircus* Linn.), the breed that dominates the goat population in the country. Statistics show that the goat population in 2001 was 3,214,621 and the backyard raisers accounted for 99% of these numbers.

Why bother with characterizing the native *kambing*? The native breed, according to animal scientists, is under a genetic threat. Because of the growing demand for goat meat, goat raisers tried to improve the productivity of the local *kambing* by upgrading the stock. In short, the native goats are crossbred with different imported breeds like the Anglo Nubian, French Alpine, La Mancha, Saanen, Toggenburg, Jumna Pari, and Boer. "Thus," according to the researchers, "the Philippine native goat germplasm is under constant threat of replacement by the transfer of genetic material from exotic breeds. Indiscriminate crossbreeding with introduced breeds poses a serious threat, which may lead to the erosion of this genetic resource."

Genetic characteristics

The native *kambing* is considered an important genetic resource, especially for smallhold farming systems (i.e. backyard faming) because of its early sexual maturity, short pregnancy

and kidding intervals, and it requires lower capital to raise, compared to carabao and cattle. These general characteristics served as springboard for Bondoc and his team in characterizing the native *kambing*. Their study presented the blood protein types, mature weight, and external body measurements, coat color and pattern, presence or absence of horns, and traits related to reproductive performance. Birth weight, weaning weight, growth rate, semen characteristics, and carcass yield were also investigated in this study.

Genetic polymorphisms were observed in *kambing* from different provinces. Polymorphism is the existence in many forms or the coexistence in the same locality of two or more distinct forms, independent of sex and not connected by intermediate gradations, but produced from common parents. Lower genetic distance values were observed in goats in adjacent provinces in Luzon. Bohol is the most isolated among the nine provinces (Pangasinan, Rizal, Batangas,

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Fungi...

microorganisms such as fungi and bacteria. They isolated two kinds of bacteria- *Penicillium* sp, and *Aspergillus* sp and one type of fungi called *Xylaria* sp.

Among the microorganisms, they reported that *Xylaria* sp. performed the best in degrading the plastic sheets. In a follow-up study, the scientists found that the *Xylaria* fungus grows best at 25°C and at pH 5. These were the optimum conditions where the fungus grew vigorously using a mineral medium with 0.5% glucose and plastic strips as co-carbon source. Fifty days after incubation, the scientists reported that the plastic strips were embedded in the mycelial mat and results of scanning electron microscopy showed that there were already visible damages on the surface of the plastic strips.

Source:

1) Virginia C. Cuevas and Rodolfo Managilod. "Isolation of decomposer fungi with plastic degrading ability". Institute of Biological Sciences of the College of Arts and Sciences of the University of the Philippines at Los Banos (IBS-CAS-UPLB), College, Laguna.

2) Virginia C. Cuevas and Ma. Theresa Clutario. "Colonization of plastic by *Xylaria* sp.". IBS-CAS-UPLB, College, Laguna.

Newsbits

JULY

ICRISAT shares watershed mgt approach for Asia drylands

Dr. Suhas P. Wani, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) principal scientist on watershed, lectured on the watershed management approach used in dry areas in Asia. The Bureau of Agricultural Research (BAR), through its Knowledge Management Division, sponsored this seminar on *Sustaining Agricultural Productivity and Incomes in the Drylands of Asia* at the Bureau of Soils and Water Management (BSWM) Convention Hall, Elliptical Rd., Diliman, Quezon City on 21 July 2004.

BAR and stakeholders aim for a UNDP project

To clinch a project with the United Nations Development Program (UNDP), the Bureau of Agricultural Research (BAR), met stakeholders to discuss their respective roles in the proposed project, "Sustainable conservation and utilization of indigenous crops and wild relatives" at the Bureau of Soils and Water Management (BSWM) on 22 July 2004. This project aims to preserve genetic resources and stall extinction of species.

AUGUST

BAR bids for ISO certification

With vision set on an ISO 9001:2000 certification by

December 16 this year, the Bureau of Agricultural Research (BAR) formally launches its ISO 9001:2000 certification process at the RDMIC lobby on 24 August, 2004. Mr. Joseph Server, president of JSA (an independent organization hired to audit BAR for the certification process), presented an overview of the ISO 2001:2000 certification process and what is expected from BAR staff and employees.

ICRISAT, DA-BAR promote production of sweet sorghum for ethanol use

The Department of Agriculture - Bureau of Agricultural Research (BAR), headed by William C. Medrano, supports the production of a newly developed sweet sorghum variety, ICV 93046 for ethanol production. The new variety was developed by the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), a non-profit international research organization based in India which is devoted to science-based agricultural development.

SEPTEMBER

DA-BAR gears up for 5th Nat'l R&D Week; Sen Magsaysay keynotes celebration

Researchers, scientists, policymakers, private sector, farmers, and fisherfolk convened on 5 October 2004, BSWM Convention Hall, Diliman, Quezon City to celebrate the 5th National R&D Week. Organized by the Department of Agriculture - Bureau of Agricultural Research (DA-BAR), this event features cutting-edge technologies in agriculture and fisheries.

Research and Development
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